

Lithologic Log Addendum

Well WB-14

Cuttings of the lithologic unit from well WB-14 were sent to the Department of Geological Sciences, New Mexico State University (NMSU), Las Cruces, New Mexico, for detailed petrographic analysis when identification of fine-grained, highly altered volcanic rocks at the NASA-WSTF site became difficult using conventional field methods. Petrographic reports from NMSU were received after the printing of these lithologic logs, hence the need for this addendum. The petrographic description from NMSU is included below.

Previous unit name based on field identification: **Tuff**

New Unit name based on petrographic analysis: **Porphyritic Andesite**

WB-14 (483')

Porphyritic augite-biotite andesite

Origin: lava flow
Texture: aphanitic porphyritic
Phenocryst
mineralogy: plagioclase + biotite + augite
Porosity: high along veins and fractures
Alteration: extreme, veins of calcite, chalcedony, zeolite, and analcite

Approximately 30% phenocrysts are present in a fine-grained altered groundmass of plagioclase, augite, oxides, and clay. Plagioclase (18%, 0.3 - 3.0 mm), biotite (8%, 0.2 - 1.5 mm), and augite (4%, 0.15 - 1.2 mm) constitute the phenocryst assemblage. Porosity is high, especially along veins and fractures. The sample is quite altered, with veins of chalcedony, zeolite, analcite, and calcite running throughout. The groundmass is also extensively altered to clay. The sample originated as a lava flow, and has been extensively altered.

WB-14 (486')

Porphyritic augite-biotite andesite

Origin: lava flow
Texture: aphanitic porphyritic
Phenocryst
mineralogy: plagioclase + biotite + augite
Porosity: high along veins and fractures
Alteration: extreme, veins of calcite, chalcedony, zeolite, and analcite

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Well WB-14 (cont'd)

This sample is identical to WB-14 (483'). See the description above.

WB-14 (515' - 520')

Porphyritic andesite ash-fall tuff

Origin: ash-fall tuff
Texture: pyroclastic, porphyritic
Phenocryst
mineralogy: plagioclase + biotite + FeTi oxides
Porosity: moderate to high in pumice fragments
Alteration: extreme, zeolite, calcite and chalcedony

This sample is fragmental, consisting of ash particles and non-welded pumice fragments. The pumice is now replaced by zeolite. Approximately 15% phenocrysts are present in a very fine-grained ashy matrix. Plagioclase phenocrysts (8%, 0.4 - 2.0 mm) are subhedral to euhedral and often broken. Euhedral biotite phenocrysts (4%, 0.2 - 0.7 mm), anhedral FeTi oxide phenocrysts (2%, 0.08 - 0.22 mm), and anhedral to subhedral augite phenocrysts (1%, 0.08 - 0.83 mm) are also present. Apatite occurs in trace amounts. Original porosity was probably high in the pumice fragments; porosity is still moderate to high based on alteration veins. Alteration is extreme. Pumice fragments are replaced by zeolite, and calcite and chalcedony are found in veins throughout the rock. The sample probably originated as an ash-fall tuff.

WB-14 (540' - 545')

Porphyritic augite-biotite-hornblende andesite

Origin: lava flow
Texture: aphanitic porphyritic
Phenocryst
mineralogy: plagioclase + hornblende + biotite + augite
Porosity: low to moderate
Alteration: extreme; clay and calcite replace phenocrysts, zeolite is present in veins and pervasively throughout the rock

Approximately 20% phenocrysts are present in an extremely fine-grained matrix of plagioclase and clay. Plagioclase phenocrysts (11%, 0.6 mm - 3.2 mm) are subhedral to euhedral, resorbed, and oscillatory zoned. Hornblende phenocrysts (7%, 0.07 - 0.6 mm) are

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Well WB-14 (cont'd)

completely replaced by calcite. Augite (1%, 0.15 - 0.3 mm) and biotite (1%, 0.6 - 1.5 mm) phenocrysts are both subhedral and replaced by clay and oxides. Biotite shows gold to dark red-brown pleochroism. Porosity is low to moderate, and restricted to alteration paths. Most of the phenocryst phases are replaced by clay and/or calcite. Zeolite is present in veins and replacing the groundmass throughout. A few fragments in this sample are extremely fine-grained and altered to chalcedony plus calcite. These could be altered volcanic ash. The majority of the fragments originated as a lava flow.